

## CLAIMS

1. In an IEEE 802.11 wireless network, a method for coordinating a power-save interval, the method comprising:
  - transmitting a first frame from an access point (AP) to a
  - 5 quality of service station (QSTA);
  - receiving an acknowledgement from the QSTA;
  - in response to receiving the acknowledgement,
  - retransmitting the first frame from the AP to the QSTA; and,
  - timing the next minimum service interval in response to the
  - 10 retransmitted first frame.
2. The method of claim 1 further comprising:
  - in response to receiving the first frame acknowledgement,
  - identifying the retransmitted first frame as the last frame in the
  - 15 transmission queue; and,
  - wherein timing the next minimum service interval in response to the retransmitted first frame includes using the retransmitted first frame as the next minimum service interval timing reference.
- 20 3. The method of claim 2 further comprising:
  - receiving an acknowledgement responsive to the retransmitted first frame; and,
  - wherein using the retransmitted first frame as the next minimum service interval timing reference includes using the
  - 25 retransmitted first frame as a timing reference in response to receiving the retransmitted first frame acknowledgement.

4. The method of claim 3 further comprising:  
failing to receive an acknowledgement from the QSTA in  
response to transmitting the first frame; and,  
5 retransmitting the first frame until an acknowledgement is  
received.
5. The method of claim 4 further comprising:  
following the minimum service interval, transmitting a  
10 polling frame from the AP to the QSTA.
6. The method of claim 5 further comprising:  
prior to transmitting the first frame, receiving a transmit  
specification (TSPEC) from the QSTA; and,  
15 transmitting frames from the AP to the QSTA at a schedule  
responsive to the TSPEC.
7. The method of claim 6 wherein transmitting frames  
from the AP to the QSTA at a schedule responsive to the TSPEC includes  
20 transmitting voice over Internet protocol (VoIP) traffic at a schedule of  
approximately 20 milliseconds between frames.
8. The method of claim 2 wherein transmitting a first  
frame from an AP to a QSTA includes setting the More Data subfield in  
25 the Frame Control field of the first frame header to a value of "1"; and,

wherein identifying the retransmitted first frame as the last frame in the transmission queue includes setting the More Data subfield to the value of "0".

- 5                   9.     In an IEEE 802.11 wireless network, a method for a quality of service remote station (QSTA) to synchronize a power-save interval, the method comprising:
- at a QSTA, receiving a first frame from an access point (AP);
- sending an acknowledgement to the AP;
- 10                   receiving a retransmitted first frame from the AP;
- sending an acknowledgement to the AP responsive to receiving the retransmitted first frame; and,
- timing the next minimum service interval in response to the receipt of the retransmitted first frame.

- 15                   10.    The method of claim 9 wherein receiving a retransmitted first frame from the AP includes:
- receiving the retransmitted first frame in response to sending the acknowledgement; and,
- 20                   identifying the retransmitted first frame as the last frame in the transmission queue; and,
- wherein timing the next minimum service interval in response to the receipt of the retransmitted first frame includes using the retransmitted first frame as the next minimum service interval timing
- 25   reference.

11. The method of claim 10 further comprising:  
following the minimum service interval, receiving a polling  
frame from the AP to the QSTA.
- 5 12. The method of claim 9 further comprising:  
engaging a power-saving mode during the minimum service  
interval.
- 10 13. The method of claim 12 further comprising:  
prior to receiving the first frame, transmitting a transmit  
specification (TSPEC) to the AP; and,  
receiving frames from the AP a schedule responsive to the  
TSPEC.
- 15 14. The method of claim 13 wherein receiving frames from  
the AP at a schedule responsive to the TSPEC includes receiving voice  
over Internet protocol (VoIP) traffic at a schedule of approximately 20  
milliseconds (ms) between frames.
- 20 15. The method of claim 14 wherein engaging a power-  
saving mode during the minimum service interval includes engaging a  
power-saving mode for approximately 14 ms between frames.
- 25 16. The method of claim 10 wherein receiving a first frame  
from the AP includes receiving a “1” bit in the More Data subfield of the  
Frame Control field in the first frame header; and,

wherein identifying the retransmitted first frame as the last frame in the transmission queue includes receiving a “0” bit in the More Data subfield.

5                   17.    The method of claim 9 further comprising:  
                    following the sending of an acknowledgement to the AP,  
                    remaining enabled to receive subsequent transmissions.

10                   18.    In an IEEE 802.11 wireless network, a system for  
                    coordinating a power-save interval, the system comprising:  
                    an access point (AP) including:  
                        a transceiver having a wireless media port for  
                        transmitting and receiving frames and a control port to  
                        communicate transceived information;  
15                          a management unit having a signal port  
                        connected to the transceiver control port to manage transceiving,  
                        the management unit ordering the transmission of a first frame to a  
                        quality of service station (QSTA), and the retransmission of the  
                        first frame in response to the transceiver receiving an  
20                          acknowledgement of the first frame, the management unit having a  
                        timing port to communicate timing information; and,  
                        a timer having a port connected to the  
                        management unit timing port to initiate the timing of a minimum  
                        service interval for the management unit in response to the receipt  
25                          of the first frame acknowledgement.

19. The system of claim 18 wherein the management unit orders the transceiver to identify the retransmitted first frame as the last frame in the transmission queue in response to receiving the acknowledgement, and,

5                    wherein the timer uses the retransmitted first frame as the next minimum service interval timing reference.

20. The system of claim 19 wherein the management unit receives an acknowledgement for the retransmitted first frame and orders  
10                    the timer to use the retransmitted first frame as the next minimum service interval timing reference in response to receiving the retransmitted first frame acknowledgment.

21. The system of claim 20 wherein the management unit,  
15                    in response to failing to receive an acknowledgement of the transmitted first frame, orders the transceiver to retransmit the first frame until an acknowledgement is received.

22. The system of claim 21 wherein the management unit,  
20                    following the receipt of a minimum service interval message from the timer, orders the transceiver to transmit a polling message to the QSTA.

23. The system of claim 22 wherein the management unit receives a transmit specification (TSPEC) from the QSTA, and orders the  
25                    transceiver to transmit frames to the QSTA at a schedule responsive to the TSPEC.

24. The system of claim 23 wherein the management unit orders the transmission of voice over Internet protocol (VoIP) at a schedule of approximately 20 milliseconds between frames.

5

25. The system of claim 19 wherein the management unit orders the transceiver to set a "1" bit in the More Data subfield of the Frame Control field in the first frame header and to set the More Data subfield to the value of "0" in the retransmitted first frame, in response to receiving the acknowledgement.

10

26. The system of claim 18 further comprising:  
a QSTA including:

15

a transceiver having a wireless media port for transmitting and receiving frames and a control port to communicate transceiving information;

20

a management unit having a signal port connected to the transceiver control port to manage transceiving, the management unit ordering acknowledgements sent in response to receiving transmissions from the AP, the management unit having a timing port to communicate timing information; and,

25

a timer having a port connected to the management unit timing port to initiate the timing of the minimum service interval for the management unit in response to the receipt of the retransmitted first frame.

27. In an IEEE 802.11 wireless network, a system for synchronizing to a power-save interval, the system comprising:

a quality of service station (QSTA) including:

5 a transceiver having a wireless media port for transmitting and receiving frames and a control port to communicate transceived information;

a management unit having a signal port connected to the transceiver control port to manage transceiving, the management unit receiving a transmitted and retransmitted first frame and ordering acknowledgements sent in response to receiving transmissions from an access point (AP), the management  
10 unit having a timing port to communicate timing information; and,

a timer having a port connected to the management unit timing port to initiate the timing of a minimum service interval for the management unit in response to the receipt  
15 of the retransmitted first frame.

28. The system of claim 27 wherein the management unit identifies the retransmitted first frame as the last frame in the  
20 transmission queue; and,

wherein the timer uses the retransmitted first frame as the next minimum service interval timing reference.

29. The system of claim 28 wherein the management unit  
25 sends an acknowledgement to the AP in response to receiving the retransmitted first frame.



30. The method of claim 29 wherein the management unit order the transceiver to engage a power-save mode in response to receiving the retransmitted first frame.

5

31. The system of claim 30 wherein the management unit receives a minimum service interval message from the timer and orders the transceiver to disengage the power-save mode in response to receiving the minimum service interval message.

10

32. The system of claim 31 wherein the management unit, prior to receiving the first frame, orders the transceiver to transmit a transmit specification (TSPEC) to the AP; and,

wherein the transceiver receives frames from the AP at a  
15 schedule responsive to the TSPEC.

33. The system of claim 32 wherein the transceiver receives voice over Internet protocol (VoIP) traffic at a schedule of approximately 20 milliseconds (ms) between frames.

20

34. The system of claim 33 wherein management unit orders the engagement of the power-saving mode for approximately 14 ms between frames.

25

35. The system of claim 28 wherein the transceiver receives the first frame from the AP with a "1" bit in the More Data

subfield of the Frame Control field in the first frame header, and receives the retransmitted first frame with a “0” bit in the More Data subfield; and,

5 wherein the management unit identifies the retransmitted first frame as the last frame in the transmission queue in response to the “0” bit in the More Data subfield.

36. The system of claim 27 further comprising:  
an access point (AP) including:

10 a transceiver having a wireless media port for transmitting and receiving frames and a control port to communicate transceiving information;

a management unit having a signal port connected to the transceiver control port to manage transceiving,  
15 the management unit ordering the transmission of the first frame to the QSTA, and the retransmission of the first frame in response to the transceiver receiving an acknowledgement of the first frame, the management unit having a timing port to communicate timing information; and,

20 a timer having a port connected to the management unit timing port to initiate the timing of the minimum service interval for the management unit in response to the receipt of the first frame acknowledgement.